FIRE

Title: **Fire - A Force for Change and Regeneration in Natural Ecosystems: An Instructional Module**

Principal Investigator: Dr. John Burger
Phone: (603) 862-1736
Fax: (603) 862-1713
Email: jfb@cisunix.unh.edu
Address: Department of Zoology
Spaulding Hall
University of New Hampshire
Durham, NH 03824

Objectives: To document long-term changes in Yellowstone landscapes affected by different intensity of fire during 1988, and to develop instructional modules, including a photographic record, explaining the role of fire in the Greater Yellowstone Ecosystem.

Findings: The year 1998 marked the 10th anniversary of the 1988 fires in Yellowstone. Documentation of short and long-term changes in vegetation affected by different fire intensities began in 1990. Observations have concentrated on lodgepole pine, aspen, sagebrush and montane herbaceous vegetation at approximately 20 selected sites, mainly in the northern half of the park. Lodgepole saplings exhibit vigorous growth in most burned areas, and saplings now average 180-240 cm in height. Growth rates averaged 30-60 cm/year in 1997 and 40-70 cm/year in 1998 in most areas. The tallest sapling was found 1 mile south of Norris Junction and was 340 cm tall. Extensive browsing of aspen by elk in the Blacktail area also has been documented. Reproduction in lodgepole saplings was first observed in 1996, eight years post-fire. Saplings examined at the Madison Junction site in 1997 indicated that approximately 5% of the saplings are beginning to produce male and female cones. Lodgepole pines in the Norris Geyser Basin and at the Bunsen Peak site also reproduced at about the same rate in 1997. In most areas, only 3-5% of saplings are producing cones in 1998, but at the Bunsen Peak site, one area had 50% of the saplings producing at least a few male and/or female cones.

Title: **Post-Burn Resource Selection, Physiological Condition, and Demographic Performance of Elk**

Principal Investigator: Dr. Robert Garrott
Phone: (406) 994-2270
Fax: (406) 994-3190
Email: rgarrott@montana.edu
Address: Montana State University
Biology Department
310 Lewis Hall
Bozeman, MT 59717

Objectives: The primary objective of this research is to evaluate the consequences of the 1988 fires on elk resource selection. Selection is being quantified for populations and individuals at multiple scales ranging from selection of patches within the landscape mosaic to selection of forages and plant parts within patches. The physiological and demographic consequences of observed resource selection strategies are being assessed through noninvasive urinary and fecal assays, and telemetry. Secondary objectives include basic research on forage plant chemical compositions, plant-animal interactions, and applied research to develop practical and rigorous management tools for population monitoring (aerial surveys, fecal steroid pregnancy assays, and snow-urine condition indices).

Findings: We have been successful in developing, testing, and applying a suit of research tools that is significantly enhancing our ability to address questions of animal resource selection and the physiological and demographic consequences of selection patterns. We have completed our seventh field season of data collection and maintain an instrumented population of 30-40 cow elk. Most publications to date have focused on techniques including population estimation, pregnancy assessment, and nutritional indices. We have completed a manuscript analyzing the demographic data thus far collected. Adult survival and reproduction is near the biological maximum for the species, but recruitment is highly variable, being strongly influenced by environmental variation, primarily winter severity. Despite this variable recruitment, extensive Monte Carlo simulations indicate that the population is relatively stable and is being regulated at approximately 600-800 animals. We have generated a database of >7,500 animal locations and are exploring a variety of analytical tools for the analysis of these data. We are also working with USGS/BRD scientists to develop appropriate GIS databases to enhance this analysis effort, and we intend to produce a manuscript based on these data within the next one to two years.

Title: **Landscape Heterogeneity and Bird Diversity under Natural and Human Disturbances in the Greater Yellowstone Ecosystem**

Principal Investigator: Andrew Hansen

See Ecology

Title: **Coarse Woody Debris and Site Productivity in Rocky Mountain Coniferous Forests**

Principal Investigator: Dr. Dennis Knight

See Ecology

Title: **Study of the Effects of the 1988 Wildfire on Yellowstone Stream Ecosystems**

Principal Investigator: Dr. G. Minshall

See Ecology

Title: **Impact of the Fires of 1988**

Principal Investigator: Dr. Daniel Norton

See Geology

Title: **Effects of Fire Size and Severity on Early Succession and Aspen Seedling Establishment**

Principal Investigator: Dr. William Romme

See Ecology

Title: **Postglacial Fire Frequency and its Relation to Long-term Vegetational and Climatic Changes in Yellowstone Park**

Principal Investigator: Dr. Cathy Whitlock
Phone: (541)346-4566
Fax: (541)346-2067
Email: whitlock@oregon.uoregon.edu
Address: University of Oregon
Dept. of Geography
Eugene, OR 97403

Objectives: The primary objective has been to study the vegetational history of Yellowstone and its sensitivity to changes in climate and fire frequency. To establish a vegetational history, a network of pollen records, spanning the last 14,000 years, has been studied from different types of vegetation within the park. A reconstruction of past fire frequency is based on information gained from: (a) a study of the depositional processes that incorporate charcoal into lake sediments; (b) a comparison of charcoal and dendrochronologic records of fire occurrence during the last 750 years; and (c) an analysis of charcoal, pollen, and magnetic properties in lake sediment cores spanning the Holocene and late-glacial periods.

Findings: Progress was made on three aspects of this project. First, revision of the Trail Lake record is underway, based on the results of radiocarbon dating and tephra analysis, which indicate that the Trail Lake record is only 8,000 years old. The results of the charcoal, pollen, and magnetic susceptibility analysis using this revised chronology were presented at the 125th Anniversary of Yellowstone National Park Science Workshop in May 1998, sponsored by Yellowstone National Park.

Second, in August we completed analysis of the ninth year of sampling of modern sediments in lakes with watersheds that were burned in 1988. This process-based study provides information necessary to interpret the charcoal record in sediment cores, by determining the time of charcoal accumulation following a fire event. The study is unique, and the results have been used by fire researchers around the world. The samples collected in August 1997 will be evaluated in light of previous results.

Third, we are collaborating with scientists from the US Geological Survey to evaluate the paleolimnologic response of Yellowstone lakes to past climate change. Samples were taken from all the long cores and have been analyzed for sediment geochemistry. Special attention has been directed to northern range lakes, particularly Crevice Lake, which has annually laminated sediments. Water chemistry and temperature measurements were obtained last summer, and plans were made to core Crevice Lake in 2000. The results of the preliminary analysis were presented at the biennial meeting of the American Quaternary Association.

Other accomplishments of note are 1.) The completion of Sarah Millspaugh's dissertation, comparing the Holocene fire history of the Central Plateau and the northern range based on two high-resolution charcoal studies. Chapters of the dissertation have been or will soon be submitted for publication; 2.)

Hosting an international workshop, sponsored by the National Science Foundation and the Inter-American Institute at the University of Oregon in June. (The objective of the workshop was to train other scientists in the methodology of fire history studies based on our experiences in Yellowstone National Park and other regions in the western U.S.); 3.) Preparation of two chapters for a forthcoming book on Fire and Climate in the Western Americas (eds. T.W. Swetnam, T.T. Veblen, and G. Montenegro). One chapter focuses on methodology of lake sediment charcoal studies; the second considers the fire history of Yellowstone and other parts of the western U.S.; 4.) Completion of a chapter on the prehistory of the Rocky Mountains, with an emphasis on the Yellowstone region. Chapter will appear in Rocky Mountain Futures (eds., J.Barron, D. Fagre, R. Hauser); and 5.) Presentation of results at the 125th Anniversary of Yellowstone National Park science meeting in May 1998.